SECTION 16620

EMERGENCY POWER SYSTEMS

PART 1 - GENERAL

0.1 DESCRIPTION OF WORK

A. Work Included: This Section specifies emergency power systems, including testing.

B. Related Work: This will include Section 08711-Door Hardware.

0.2 SUBMITTALS

A. Shop Drawings. Include single line diagrams showing equipment ratings for each emergency system; schematic wiring diagrams of equipment; connection wiring diagrams of all equipment; equipment outline drawings; and interconnection wiring diagrams for each emergency power system.

B. Instruction Manuals. Furnish detailed printed instructions and maintenance manuals for each emergency power system. Include in the instruction and maintenance manuals at least the following: Complete circuit diagrams; detailed parts lists including details of parts furnished by other than the principal manufacturers; suggested list of spare parts to be kept on hand; description of maintenance procedures and methods; and detailed operating instructions.

C. Tests. Submit test procedures and results for tests specified herein.

D. Submit evidence of compliance with mean time between failure (MTBF) requirements specified herein, prior to delivery or installation of the equipment.

0.3 QUALITY ASSURANCE

A. Shop Tests. In addition to the standard tests carried out by the manufacturer upon completion, in accordance with the IEEE Standards, and two weeks prior to shipment, perform the operational tests required, on one unit of type or design and size, to verify compliance with Specifications.

B. Capacity or burn-in: Rated kw, 0.8 power factor, at 86˚F ambient for 120 hours. Record temperature readings.

C. Transient Response

1. Simulate an inverter failure, which would cause the rated kw load to transfer from inverter output to auxiliary power sources.
2. Manually return the rated kw load from auxiliary power source to inverter output.
3. Same as above, except automatic return with 60 seconds by a timer.
4. Simulate an input AC power failure to the battery charger.
5. Simulate a battery charger failure.
6. Simulate a battery failure.
7. Record the results of the above tests with oscillograms.

D. Short-Circuit Tests

1. Short the output bus to record the current-limiting effect of the inverter.
2. Short the output of one of the branch circuits to measure clearing time.
3. Record the results of the above tests with oscillograms.

E. Voltage Regulation Test

1. Measure the inverter output voltage with the inverter in the no load, 1/2 load, and full load conditions.
2. Using plus or minus 10% variation of input voltage record the output voltage.

F. Test Data. Assemble test data in booklets for submittal as specified.

G. Corrective Measures. If test show that certain requirements are not met, make necessary corrections to the equipment so it will satisfy all requirements before acceptance is made.

H. Reliability. Provide equipment with specified mean time between component failures of 40000 hours, determined in accordance with MIL-STD-781, Test Plan I.

0.4 DELIVERY, STORAGE, AND HANDLING

A. Ship battery cells assembled, fully charged and filled to the proper level with electrolyte, and boxed in shipping crates of adequate strength to protect them during shipment, handling, and storage. Package accessories in separate shipping cartons.

PART 2 - PRODUCTS

0.1 GENERAL

A. Furnish the products which form a part of each emergency power system as a completely coordinated, packaged system consisting of the battery,

battery charger, DC to AC inverter and static transfer switch assembly as principal elements. Mount all principal elements, except battery, in a single enclosure. The battery and inverter/charger/rectifier unit with static transfer switch shall be located together in a battery room separated from other electrical equipment.

0.2 ENCLOSURE

A. General. NEMA 1A in accordance with NEMA Standards IS 1-1; freestanding, ventilated, welded type formed of sheet steel. Provide the front of each enclosure with panel type hinged doors with provision for mounting required meters and accessories. Provide a forklift base for ease of moving the unit. Provide a three-point latch and equip the door for a cylinder type lock indicated under Section 08711 - DOOR HARDWARE.

B. Ventilation. Provide the battery charger and the inverter with natural or forced convection cooling by means of louvers or screened grills to permit satisfactory operation under ambient temperatures of up to 104˚F. Filters shall be removable for ease of maintenance and replacement.

C. Finish. Debur and degrease the enclosure following fabrication. Apply a phosphate bath to the enclosure as a unit, followed by a coat of rust-inhibiting primer and at least two coats of ANSI No. 61 gray paint. Bake each coat and rub smooth.

0.3 BATTERY

A. General. Provide lead-calcium type batteries complete with racks and accessories, each battery consisting of 60 cells to provide a nominal open-circuit voltage of 120 volts at full charge.

B. Capacity Rating, Ampere-hours. Sufficient to supply required input to the inverter when operating at its rated kva output at 80% power factor for one and one-half hours at a maximum ambient temperature of 104˚F. Without its terminal voltage dropping below 12-1/2 percent of nominal (105 volts).

C. Cell Containers

1. House each cell in a high impact strength polystyrene container, resistant to heat distortion and acid electrolyte.
2. Provide cell containers with integral molded ribs as required to support the internal elements of the cell without developing internal stresses due to variations of temperature.
3. Provide containers, which are impact resistant, of uniform thickness, and free from internal stresses.
4. Provide a sediment space below the cell plates so that sediment need not be removed during the normal life of the cell. The sediment space shall be sufficient so that sediment shed by the plates during the life of the cell cannot short circuit the cell.

5. Provide containers of a design that permits the application of a cover properly sealed thereto.
6. Provide lines indicating the levels of electrolyte to be maintained on four sides of each container.
7. Fabricate covers of insulating material designed to prevent sagging, free from circuit leakage and impurities detrimental to the plates or separators, and impervious to absorption of electrolyte.
8. Seal the covers to the jars to form a permanent leak proof seal. Provide the covers with a vent plug designed to minimize electrolyte spray and completely flat except for the raised neck of the vent plug well.
9. Provide cells with sufficient electrolyte to provide for full capacity at all ratings, having a nominal specific gravity of 1.200 to 1.220 at 77˚ when the cells are fully charged.

D. Battery Rack. Number of tiers as indicated, constructed from not less than 2 inch by 1-1/2 inch by 1/8 inch steel angles as frames and not less than 1-7/8 inch square section steel channel rails. Construct bracing members from not less than 1-1/2 by 3/16 inch steel bars bolted to the frames with washers. Finish paint racks with at least two coats of acid resistant gray paint. Equip rails with plastic covering channels arranged to fit snugly over the steel, the plastic material having a dielectric strength of 5,000 volts minimum and a high resistance to deterioration from acid. Battery rack shall be designed for Seismic Zone 3.

E. Accessory Equipment. Furnish the following accessory equipment with each battery:
1. Syringe hydrometer with specific gravity scale 1.170 to 1.230.
2. Vent-mounted hydrometer syringe.
3. Vent-mounted thermometer.
4. Set intercell connectors to provide 1/2 inch spacing between cells.
5. Set inter-rack and load terminal lugs.
6. Lifting strap and strap spreader for lifting cells with mechanical lifting device.

0.4 BATTERY CHARGER

A. General. Completely automatic, silicon controlled rectifier, solid state type; operating from a supply voltage rated at a nominal 480/277 volts, three-phase, four wire, 60 hz, and converting this supply voltage to direct current of the proper characteristics for charging the battery with float and equalizing charge rates, with the float and equalizing voltages adjustable between the ranges required for the battery; having adequate capacity to fully recharge the battery in twelve hours, including automatic equalizing charge period, after the battery has been discharged to a level of 105 volts at its stated discharge rate; capable of simultaneously supplying rated inverter input and a switchgear control power load characterized by an average requirement of 10 amperes with possible short-time peaks of

approximately 90 amperes imposed on the battery charger and battery combination by circuit breaker operation.

B. Equipment Features. Provide each battery charger with the following items, each clearly identified by a permanent nameplate stating its function:

1. DC Voltmeter, range 0 to 150 volts.
2. Charge ammeter.
3. Automatic equalizer charge timer.
4. Pilot light, marked AC SUPPLY/
5. Adjustable ventilation cycle timer, with manual ON position, to activate battery room vent fan, 120 volts, 60 hz, during high rate charge periods. This item may be furnished as a separate unit.
6. Pilot light marked VENTILATION.
7. NO CHARGE relay for indicting to supervisory control system failure of charge output for any reason.
8. Incoming power molded case 480 volt rated, 3-pole circuit breaker with clearly marked position indication.
9. Nameplate containing manufacturer's type and serial number, complete rating information, and wiring diagram reference number.
10. Current limiting fuses to protect rectifier SCR's.

C. Automatic Protection and Control. Provide charger with output current automatically limited to the eight-hour discharge rate for the battery to prevent the cell temperature from exceeding 110˚ during the recharge cycle. Provide the equalizing timer adjustable from zero to 72 hours. Provide automatic recharge after discharge, which will override the normal cycle for full float charging. Provide the battery charger with built-in protection from overload including short circuit of the output terminals, by means of a current limiting device or circuit which will limit the output current to the rating of the battery charger without disconnecting it from the battery or AC supply.

D. Manual Charging Control. Install a three-position manual selector switch in the panel door, marked AUTOMATIC, FLOAT, and MANUAL EQUALIZE. In the automatic position, the battery charger shall function in the automatic cycling manner described above. In the float position, the battery charger output shall be limited to the float condition and shall permit adjustment of the float rate. In the manual equalize position, the battery charger shall apply equalizing voltage to the battery and permit adjustment of the equalizing rate. Rate adjustments shall be made by means of screwdriver operated devices mounted within the battery charge, behind the panel door. The adjustment devices shall be clearly identified as to function.

0.5 INVERTER

A. General: Entirely solid state with no moving parts.

B. Inverter Characteristics and Rating:

1. Inverter input: Supplied from emergency storage battery, range 140 volts to 105 volts, DC.
2. Inverter output: 480/277 volts, three phase, four-wire, 60 hz.
3. Inverter output rating: As indicated.
4. Inverter output wave form: Sine wave with maximum of five percent total harmonic distortion.
5. Inverter output voltage regulation: Plus or minus one percent from no load to full load at unity power factor.
6. Inverter output frequency regulation: Plus or minus one percent of 60 hz over entire output range.
7. Inverter overload capacity: 150% of full load for 10 seconds, 125% of full load for 20 minutes.
8. Inverter starting characteristics: Start into any load within its overload rating without improper operation and attain full output voltage within 200 milliseconds after input voltage is applied.
9. Inverter stability characteristics: When operating at minimal or no load, inverter output voltage shall stabilize within three percent of steady-state within five cycles after sudden application of full rated load.
10. Power-wound components: Class F insulation.
11. Internal wiring bundled with each conductor having an identification tag.
12. All hardware: Corrosion resistant.

C. Inverter Accessory Equipment: Provide each inverter with:

1. DC Ammeter.
2. AC Voltmeter with Phase Selector Switch.
3. AC Ammeter with Phase Selector switch.
4. AC Frequency Meter (Pointer Type).
5. DC Input Circuit Breaker.
6. Manual test switch with interlock circuit to DC contactor specified herein to permit test of inverter operation.
7. Provide the following indicating lights:
    a. Amber - System AC Power ON
    b. Red - Battery ON HIGH Charge
    c. Green - Inverter Emergency System Operating
    d. Red Flashing - Low Battery Electrolyte
    e. Blue Flashing - Maintenance Bypass Switch ON
    f. Battery Low
    g. Input Power Failure
    h. Fuse Failure
8. Provide auxiliary dry contacts for remote monitoring.

0.6 STATIC TRANSFER SWITCH WITH MANUAL BY-PASS SWITCH

A. Provide a high speed static transfer switch, which is static, solid state, and will complete the automatic transfer in 1/4 cycle or less. Provide for adjustment of the under-voltage transfer to alternate source and independent adjustable level for automatic retransfer, with time delay.

B. Include a manual by-pass switch to transfer the load to the AC supply for maintenance of the static switch and inverter.

C. Rate these switches for compatibility with the inverter, and locate them in the inverter cabinet.

PART 3 - EXECUTION

0.1 GENERAL

A. Install the emergency power system as indicated and in accordance with the manufacturer's instructions. Anchor equipment firmly in place, test and adjust for proper operation in accordance with the manufacturer's instructions.

0.2 BATTERIES

A. Install batteries complete on racks in the battery room. Connect battery cells to adjacent cells on the same rack by means of intercell connectors. Where cells to be connected are on different racks, make the connection by copper conductors with THW insulation, in hot-dipped galvanized steel conduit. Equip conduit with suitable fittings having two hole porcelain covers for the wire. Install conduit for connections to the load and battery charger.

0.3 FIELD TESTS

A. Upon completion of the installation, demonstrate to the satisfaction of the Engineer that each completed system will perform as required. Perform test of system protection and annunciation as well as operation.

PART 4 - MEASUREMENT AND PAYMENT

0.1 MEASUREMENT

A. Emergency power systems will be measured as per each complete in place, including all preparation, accessories and incidentals.

0.2 PAYMENT

A. Payment for emergency power systems will be made at the Contract unit price for the quantities as specified above.

0.3 PAYMENT ITEMS

ITEM NO.	DESCRIPTION	UNIT
1630.162	EMERGENCY POWER SYSTEMS	EA

END OF SECTION